

REMARKS

Examiner Shingleton is thanked for the detailed explanation for the basis of certain of the rejections set forth in the Office action.

Claim Rejections—35 USC 112

Independent claims 1 and 9—and thus their dependent claims 3-8, 10, 11, 13-17, 19-26 and 30-33— have been amended to more particularly point out specific structure that implements applicant’s broad invention and various specific embodiments thereof. It is therefore submitted that the rejection under 35 USC 112, second paragraph, has been overcome.

Claim Rejections—35 USC 102

Claims 1, 3-11, 13-17, 19-26 and 30-33

Applicant agrees that there is a significant degree of similarity between the cited Prokin circuits and the circuits disclosed by applicant.

However, independent claims 1 and 9— and thus their dependent claims 3-8, 10, 11, 13-17, 19-26 and 30-33— define the recited “means for generating” and the “means for applying” to have specific functions neither shown nor rendered obvious by Prokin. See, amended claim 1, lines 11-16 and amended claim 9, lines 10-16.

The Office action asserts at (p. 7) that “if one were to connect[ed] the interconnected load to the switching amplifier of Prokin, this would result in the combination functioning exactly as that of applicant’s combination of switching amplifier and interconnected load.

But this is not so. Applicant demonstrated in detail at pp. 16-19 in applicant’s “Response to Office Action” dated 11/10/2006 that the circuitry in Prokin that generates the switching signals and applies them to the loads does not give rise to baseband currents flowing in Prokin circuit in the manner required by applicant’s claims at lines 13-18 of claim 1 and lines 10-16 of amended claim 9. For the examiner’s convenience, the

Remarks of applicant's 11/10/2006 paper are attached hereto as Appendix I. Again, the examiner is invited to re-consider pp. 16-19 thereof.

Specifically, applicant pointed out that the currents in the loads in Prokin flow in the same direction, not in the opposite direction. This being so, applicant demonstrated how the currents in Prokin do not meet, for example, the limitation of amended claim 1 that "the sum of the values of the instantaneous currents through said each load is substantially constant." In Prokin, contrary to claim 1, that sum is not substantially constant.

For the same reason, the currents in Prokin do not meet, for example, the limitation of amended claim 9 that "substantially all of the current at baseband frequencies that flows out of one or more of said loads at a given time [flows] into one or more of the others of said loads." In Prokin, as applicant has previously noted, the currents in both loads flow in the same direction into the node that connects them. Again, see Appendix I at pp. 16-19.

Moreover, no obvious modification of Prokin, nor any adjustment of any parameters in Prokin could possibly cause the aforementioned limitations of claims 1 and 9 to be met. Prokin's circuit simply does not and cannot operate to have currents that flow in the manner that claims 1 and 9 require.

Claim Rejections—35 USC 103

Claims 34, 35 and 41

In rejecting claims 34, 35 and 41, the Office action finds that, upon defining a workable/optimum range of component values, a person skilled in the art would arrive at limitations of lines 17-19 of independent claim 34—namely that "substantially all of the current at baseband frequencies flowing in said two or more circuit paths flows through the respective reactive load." See the Office action at p. 8, lines 7-14.

Whether or not THAT limitation would be met, the Office action does not address the limitations of claim 34, lines 15-17, stating that "all of the current at baseband frequencies flowing out of one or more of said loads at a given time flows into one or more of the others of said loads."

Indeed, that limitation, at a minimum, distinguishes the claimed invention from Prokin as well as from any obvious modification or optimization of Prokin.

As noted above and in the extensive discussion in Appendix I, current flows in all of Prokin's loads into the node that connects them. As such, as also previously noted relative to claim 9, Prokin's circuits do not meet the limitation of claim 34, lines 15-17, that "substantially all of the current at baseband frequencies flowing out of one or more of said loads at a given time flows into one or more of the others of said loads,"

It would be impossible without making changes to the structure and functionality of the Prokin circuit to make the Prokin circuit meet this limitation of claim 34. Certainly, no matter in what manner the person skilled in the art might define a workable/optimum range of component values for the Prokin circuit, in no case would Prokin meet the limitations of claim 34, lines 15-17.

Claim 42

Claim 42 distinguishes the invention from Prokin or any obvious modification thereof for at least the reasons set forth above relative to its base claim 34.

Claims 36-39 and 63-68

Applicant will accept at least for purposes of argument that the use of a common mode inductor in a switching arrangement is commonplace so as to filter out a common mode component, should there be one.

However, as applicant has noted previously (see Appendix I, pp. 19-20), Prokin's signals are the exact opposite of common mode signals. They are all differential mode signals and so Prokin teaches directly away from the idea of including any kind of common mode filtering. There is no teaching in Prokin, nor would it be obvious therefrom that reducing any small incidental amount of common mode switching components would have any effect on the overall function of the Prokin circuit or the quality of its outputs. Thus the person of ordinary skill would have no reason to include common mode filtering in the Prokin circuit.

Claim 63

The Office action does not address significant limitations in claim 63 not shown in

Prokin nor rendered obvious by any combination of Prokin with other cited prior art.

Applicants have made the same points on several occasions and it still not seen by applicant how any Office action has addressed applicant's points in regard to claim 63.

Applicant hereby takes the opportunity to repeat what was said in applicant's Response to Office Action dated 12/26/2006:

1) Lines 7 - 9 of claim 63 call for load filters with unique characteristics, specifically, "each load filter having a passband that includes said particular switching frequency and having a stop band at frequencies higher than said particular switching frequency." These are, for example, applicant's filters 39 and 43 of FIG. 4A. **Prokin does not have any such filters.** And certainly **Prokin does not have any such filters that meet the unique limitation above relative to their passband and stop band.**

2) Lines 17-18 of claim 63 say that the two switching signals for the two loads have respective fundamental switching components are of substantially equal magnitude and substantially equal phase. In Prokin, the switching components at the fundamental (modulating, carrier) frequency are of opposite phase. On this point, applicant has previously pointed out that Prokin indicates at col. 7, lines 53-63 that the pulse-width modulated signals PWM1, PWM2, PWM3 and PWM4 are typically counter phased for switches of the same load phase. Since Prokin's signals are "counter phased" this means that all of the frequency components of PWM1 (PWM3) are the inverse of the corresponding components in PWM2 (PWM4). That is they are of opposite phase, not of "equal" phase as applicant's claims recite.

Claim 69

Claim 69 distinguishes the invention from Prokin or any obvious modification thereof for at least the reasons set forth above relative to its base claim 63.

Note Re: Rejection of claims 1, 3-5, 7-9 13, 17, 19, 20 **as being "Omnibus Claims"**

As noted above, the amendments made to independent claims 1 and 9 obviate the rejection under 35 USC 112, second paragraph. Applicant notes for the record, however, that these are not omnibus claims. As the examiner has correctly noted, an omnibus claim

is a claim of the form “A device substantially as shown and described.” Obviously none of applicants claims are anything like that.

Withdrawn Claims

In view of the foregoing discussion indicating that the claims currently under examination are allowable, it is respectfully requested that the withdrawn claims be rejoined in this case and be allowed along with the claims now pending.

Reconsideration is requested.

George G. Zipfel, Jr.

By: _____

Ronald D. Slusky
Attorney for Applicant
Reg. No. 26,585
(212) 246-4546

Office of Ronald D. Slusky
Registered Patent Attorney
353 West 56th St—Suite 5L
New York, N.Y. 10019
Date:

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REMARKS MADE IN APPLICANT'S
RESPONSE TO OFFICE ACTION
DATED 11/10/2006

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Advisory Action

The Advisory Action states that the reason the claims are not in condition for allowance is that applicant is reading the too narrowly the limitation that (in the words of claim 1)

“the sum of the values of the current through said each load is substantially constant.”

Specifically, the Advisory Action states that the current referred to in this limitation (and similar limitations in other claims) could encompass *average* current and that the claim, so read, would be anticipated by the prior art.

Telephone Interviews

The outstanding Final Office action was discussed in telephone conversations on or about November 2 and 8, 2006. The discussion centered around the Prokin reference and how applicant's claims, either in amended or unamended form, might distinguish over Prokin. No agreement was reached.

Among the possible claim amendments discussed was that of amending the claims to talk in terms of the “instantaneous” current. Examiner Shingleton was understood to say that he thought that such an amendment would probably distinguish over the art of record, but would require a new search. Applicant has thus assumed that a response making such an amendment would not be entered and applicant has chosen, therefore, not to present any such amendment at this time.

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Applicant's Response to Advisory Action

Prokin's Currents Flow Differently From Applicant's And Thus Do Not Sum To A Constant, Whether One Considers The Instantaneous Current Or, Per The Office Action, The Average Current

Let it be assumed that, as the Advisory Office action suggests, the term “current” can read on “average” current. Applicant's claims still do not read on Prokin because neither the instantaneous, nor the average current, in Prokin is “substantially constant.” This is because the directions of current flow are completely different in Prokin from the directions of current flow in applicant's embodiments.

By convention, current flowing into a node is positive and current flowing away from the node is negative. Referring to applicant's FIG 4A, for example, the currents in loads L1 and L2 flow in opposite directions relative to the node where they meet. When the current in L1 flows “down” into that node it is positive current, while the equal-magnitude current in L2 flows “up” out of that node and is negative. Thus the two currents sum to, in this case, the constant value of ≈ 0 . Looked at mathematically, if the current in L1 were to be a sinusoid ($\sin \omega t$), then the current in L2 would be its opposite ($-\sin \omega t$), so that their sum is $(\sin \omega t) + (-\sin \omega t) = 0$.

The exact opposite is true in Prokin because the currents in the loads flow in the same direction, not the opposite direction. This is explained in detail below under the heading “**How Do We Know That Prokin's Load Currents Flow In The Same Direction?**” Since the currents in Prokin's loads flow in the same direction to or away from their common node, they do not sum to a constant at that node. When one current is positive (flowing to the left, say), the other current is also positive. Similarly, when one current is negative (flowing to the right, say), the other current is negative. Their sum is thus not a constant because their absolute values add rather than subtract. Following through with the same example, if the current in 51 is the sinusoid ($\sin \omega t$), then the current in 52 would also be that same sinusoid ($\sin \omega t$), so

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that their sum is $(\sin \omega t) + (\sin \omega t) = 2(\sin \omega t)$. That is, the sum of the currents is itself a sinusoid and therefore is not substantially constant. The same argument applies if one considers the “average” current. Indeed, Prokin specifically says that the average current values through both 51 and 52 “are directed from the power supply 1 [emphasis added.]”

How Do The Independent Claims Distinguish?

Independent **claim 1** thus distinguishes the invention from Prokin at least by virtue of its recitation that “*the sum of the values of the currents through said each load is substantially constant.*”

Independent **claims 9, 34, 63** embody the same idea in different words. Instead of talking about the sum of the values of the currents being equal, they say that substantially *all of the current at baseband frequencies flowing out of one or more of said loads flows into one or more of the others of said loads* or words to like effect. In terms of applicant’s FIG. 4 picture, substantially all of the baseband current flowing out of load L1 flows into load L2, and vice versa, and there is negligible current through power supply 32. Again, this is directly contrary to what happens in Prokin. In Prokin, when baseband current flows out of load 51, baseband current also flows out of load 52. The current of both loads, then, flows into power supply 1. A similar thing happens for the other direction of flow.

How Do We Know That Prokin’s Load Currents Flow In The Same Direction?”

1. It is quite easy to see from Prokin’s own words that the baseband load currents flow in the same direction. See col. 8, lines 22-28, which is talking about the baseband currents that drive the loads. (Per standard switching amplifier practice, the switching frequencies are suppressed. See below.) Prokin there says that average

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current values through both phases 51 and 52 are directed from the power supply 1. There we have it, pure and simple. The currents flow in the same direction.

2. The idea that the baseband currents flow in the same direction is also evidenced by the fact that, as Prokin then says, the fluxes cancel each other. Given the direction of the windings as evidenced by the little dots shown in 51 and 52, such flux cancellation can only happen if the currents are flowing in the same direction. This makes perfect sense because flux cancellation means reduced back e.m.f. which, in turn, means low impedance for those baseband signals. See, for example, page 28 of the article appearing at <http://www.murata.com/emc/knowhow/pdfs/te04ea-1/26to28e.pdf>, which is attached hereto for the examiner's convenience. Note, in particular the statement at the top of page 28 indicating that when flux is canceled out, impedance is not produced.

By contrast (Prokin col. 8, lines 33-38), the high frequency components (which Prokin calls the modulated current components) are in opposite directions, which is how they get canceled

3. Prokin's load currents are "identical" (col. 8, line 47). If they flowed in opposite directions, (e.g., to the left through 51 while flowing to the right through 52 or vice versa), then no current would be flowing through power supply 1 at any time (by Kirchoff's current law) and so no energy would be available to be delivered to the loads or to charge up capacitor 6. None of that can be true, of course, thus proving that the currents in Prokin cannot flow in opposite directions per the above assumption but, rather, must flow in the same direction. Thus, contrary to claim 1, they don't sum to substantially a constant. And contrary to claims 9, 34 and 63, it is not the case in Prokin that all the baseband current flowing out of load 51 flows into load 52 or vice versa.

4. Prokin generates his switching signals in the opposite sense to the way applicant generates them. This makes it all the more logical that the relative directions of current flow would be different. Note, in particular, that applicant's switching waveform—illustratively triangle wave T shown, for example, in FIGS. 3A and

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3B—are in phase, resulting in in-phase components at the switching frequencies. By contrast, Prokin's entire PWM signals (switching frequency and baseband components) are the inverses of one another. Reference may be made to col. 7, lines 53-63 of Prokin, which indicates that the pulse-width modulated signals PWM1, PWM2, PWM3 and PWM4 are typically counter phased for switches of the same load phase. Since Prokin's signals are "counter phased" this means that all of the frequency components of PWM1 (PWM3) are the inverse of the corresponding components in PWM2 (PWM4) .

Common Mode Inductor—Claims 24-26, 32, 33, 36-39 and 63-68

Applicant's embodiments include a common mode inductor as a way of canceling in-phase (common mode) components at the switching frequencies. Applicant again urges that there would be no reason or purpose served in putting a common mode inductor (or any other signal-canceling means) in the Prokin circuits, as recited in claims 24-26, 32, 33, 36-39 and 63-68 since Prokin's switching frequencies are differential mode signals. This point was made in at least two prior Responses.

This issue was discussed in the aforementioned telephone conversations. Applicant understands the examiner's position to be that there might be some very small common mode components at the switching frequencies and therefore that it would be obvious to the person of ordinary skill to include a common mode filter or the like if it was desired to have, say, a super-clean signal in which any such small amount of common mode signal could be reduced.

Applicant disagrees with this. There is no teaching in Prokin, nor would be obvious therefrom, that reducing the small common mode switching components that the examiner has postulated would have any effect on the overall function of the Prokin circuit or the quality of its outputs. Thus there would be no reason for the person skilled in the art to think of including any kind of common mode rejection

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circuitry in Prokin. Indeed, since Prokin's signals are all differential mode signals, Prokin teaches directly away from any such concept.

Claim 63's Unique Filter Recitations

Claim 63 further distinguishes the invention from Prokin.

1) Lines 17-18 say that the two switching signals for the two loads have respective fundamental switching components are of substantially equal magnitude and phase. In Prokin, the switching components at the fundamental (modulating, carrier) frequency are of opposite phase

Lines 7-9 call for load filters with unique characteristics, specifically, "each load filter having a passband that includes said particular switching frequency and having a stop band at frequencies higher than said particular switching frequency." These are, for example, applicant's filters 39 and 43 of FIG. 4A. Prokin does not have any such filters. And certainly Prokin does not have any such filters that meet the unique limitation above relative to their passband and stop band.

The Question of "Average" Current and Current Components

As noted above, the Advisory Action asserts that the claim recitations of "current" can be read on an "average" current. In addition, in the above-mentioned telephone conversations, the Examiner expressed the view that the recitation of a "current" can read on an "average" current or on a "component" of a current such as its DC component.

These issues have been rendered moot by the points made above.

However, applicant must note his disagreement with such a reading.

It is true that an examiner must give claim recitations their broadest reasonable meaning. It is submitted, however, that the interpretation just mentioned is not a reasonable way to read a limitation calling for a current.

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Both an “average” current and a “component” of a current such as its DC component are not actual currents. A current is a flow of charges. An average current or a component of a current are nothing more than mathematical computations or constructions. There is no such a physical thing as an “average” current. This is simply a number reflecting a certain characteristic of a real current.

Similarly, the DC component of a current (unless the current is ONLY DC, which is not the case here) is not a physical current. There is no subset of charges in a current that are all flowing in one direction so as to constitute a separable component of the current. Rather, a current that has multiple components consists of charges moving in various directions over time and one can mathematically describe that movement in terms that would include a DC component. But that DC component is just a number reflecting, typically, some average value of the charge flow. It is not a current.